~~Addendum to~~
Hacienda Buena Vista
(Hacienda Vives) (Buena Vista Plantation)
Km 16.5, PR Route 10, Ponce to Arecibo
Magueyes
Municipality of Ponce
Puerto Rico

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HISTORIC AMERICAN ENGINEERING RECORD

Hacienda Buena Vista
(Hacienda Vives) (Buena Vista Plantation)

PR-4

Location:	Km 16.5, PR Route 10, Ponce to Arecibo, Magueyes, Municipality of Ponce, Puerto Rico
Date of Construction:	1847-51
Present Owner:	Vives family
Significance:	The hacienda encloses, in a unique fashion, the basic processing elements which characterized an independent corn and coffee hacienda in mid-nineteenth century Puerto Rico: household and industrial structures; a rare Barker-type turbine used for corn grinding; a waterwheel; a coffee pulping mill; a coffee husking mill; and an aqueduct.
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Transmitted by:	Jean P. Yearby, 1984

Introduction

Nineteenth century Puerto Rican industrial development was a personal, family affair. It was not a capitalistic, "modern" enterprise, as were the cases of Western Europe or North America. Therefore, a different frame of reference should be assumed to understand fully its formation and transformation; otherwise, a distorted interpretation might result. For example, it should be stressed from the beginning that Puerto Rico did not determine its socio-economic and political course throughout the last century, since the island, as a Spanish colony, developed within a socio-economic and political milieu exclusively shaped by Spanish Colonialism. An illuminating instance is the case of Hacienda "Buena Vista," a corn mill and coffee hacienda owned by the Vives family since the mid-1830s.

Traditionally, the capitalist mode of production has been characterized as a system in which society is divided into two groups: those who own the means of production, e.g., land, factories, mines, etc., and workers who sell their capacities to produce goods for a salary. The workers' manufacturing functions are carried out in a factory or workshop in which machine and manual work are combined to produce goods. Finally, society as a whole is permeated by the idea of profit.

As a general pattern, this description of traditional capitalism does not apply to 19th century Puerto Rico. Even more, 19th century Puerto Rican socio-economic development was retarded by a series of highly complex and unique characteristics, which at this point are under careful scrutiny by Puerto Rican social historians. Throughout their research, they found that, contrary to a capitalist industrial form of production, 19th century Puerto Rican "industry" was shaped by a feudal form of production entirely dependent on a one-crop commercial agriculture: sugar, coffee, and/or tobacco. This type of social production has been described as lacking an organized free labor force market capable of selling its productive capacities to a freely chosen "boss," since it is tied to the landowner's power in a feudal serf-landlord relationship. Within this relationship, black slavery played a major role until the last quarter of the century when it was legally abolished. Furthermore, it was one-crop commercial agriculture which seriously limited the development of local markets, the circulation of sound currency and banking institutions, and the development of communication. On the other hand, growing dependency on foreign importations, especially manufactured goods, caused the merchant class to develop as members of the ruling class. This class, predominantly Spanish, controlled the available circulating currency, and became the purveyors of sound currency -- silver and gold --, credit, and the bulwarks of status quo. The merchant class became willing instruments of Spanish colonialism until 1898, which guaranteed the Mother Country's hegemony on the island.

The "industry establishments" of 19th century Puerto Rico evolved into independent socio-economic productive units linked to the outside markets through commercial and family ties. A recent study of another coffee hacienda, the Hacienda "Pietri-Mariani" in the southern town of Yauco, west of Ponce, corroborates the previous statements:

> "The Pietri-Mariani family, originally from French Corsica, while actively participating in natural/pre-capitalistic/island economy, lived within the mentality of a second half 19th century Europe. They were coffee growers and merchants, which allowed them to escape from the traditional profiteers; on the contrary, they were the money lenders who took possession of land in payment for unpaid debts. They expanded their socio-economic power through the acquisition of considerable extensions of [arable] land by purchase of execution; and by doing this, plus manipulating prices and markets for coffee, became the "Senores" of the material and spiritual life of the region. They also maintained the umbilical cords with Europe and the culture that provided their frame of reference: they sent their sons to study in Europe; sustained close relationships with their relatives that stayed behind; enjoyed moments of unforgettable pleasure in Barcelona, Corsica, Paris, and Marseilles; . . . ornamented their table with exquisite linen; and the smoke from the fine imported cigars dimmed the flashing of the jewels . . . To the Pietri-Marianis, the world was relatively fine; enlivened, here and there, by the "Galop, the Mazurka, the Britano, the Cotillion, the Polka . . ." For the [peasant] and for the small and medium proprietors, for the dispossessed of the earth, for the indebted, it was a coarse and vulgar world, immersed in the "salted cod fish, the chick peas, the rice, the soup noodles, the lard, the suet, the bees was . . ."*

The analysis which follows, encompassing the Vives family genealogy, agricultural land aggregation process, slavery, "industrial" production, credit sources, etc., is considered necessary to understand 19th century Puerto Rican industrial development in general; but in particular that of a coffee hacienda which uniquely combined corn-milling and coffee husking technology.

Development

The development of Hacienda "Buena Vista," commonly known as Hacienda "Vives," is a typical example of a socio-economic institution which proliferated in 19th century Puerto Rico: the

family enterprise. The head of the family, Salvador de Vives, and his wife, Maria Isable Diaz, came to Puerto Rico from Venezuela probably as part of the royalist emigrants that flooded both Cuba and Puerto Rico as a result of the Spanish-American Wars for independence. [1] Although their date of arrival is not exactly known, they might have arrived in Puerto Rico sometime during the 1820s, since by 1830 Salvador de Vives was already a Spanish Colonial officer in the town of Ponce, acting as the Port of Ponce Secretary of Registers. [2] Their only son, Carlos Maria Vives, was born in Caracas, Venezuela, in 1812. [3]

The business records throughout the decade make it possible to conclude that the origins of Hacienda "Buena Vista: were rooted in the 1830s. It was precisely in 1830 that the first business transactions pertaining to Salvador de Vives were found. [4]

After Salvador de Vives' death on November 24, 1845, the hacienda was inherited by his son who had actually been in charge of all legal matters related to his father's economic interests since 1843. [5] Carlos Maria had three children from his marriage to Guillerma Navarro: Salvador, the eldest, Carlos, and Guillermo. Upon Carlos Maria's death on September 29, 1872, the children and their mother inherited the hacienda. [6]

The hacienda followed a gradual growth pattern through land and slave purchases and money lending. As stated before, the bulk of the land which comprised the hacienda was acquired by Salvador de Vives during the 1830s and early 1840s. The land aggregation process, which gave way to the formation of the hacienda, will be dealt with later on.

Evidence proves that one of the most important mechanisms used for the gradual buildup of the family's wealth was the purchasing and selling of slaves. The transactions took place consistently during the 1830s and 1840s; although a very important one took place in 1860 involving 46 slaves. [7] The last one recorded dates from 1871 (8], two years before the legal abolition of slavery. In the span of forty years, the Vives family was involved in 55 slave purchases and 50 slaves. Of these, 37 took place in the 1830s and 15 in the 1840s.

The following estimates have been made for the period 1830-1870, as they refer to slaves and prices: the Vives bought 101 for the total price of 27,852 Spanish silver pesos (roughly equivalent to $US 1.00 in 1854 exchange), and sold 115 for a total amount of 57,337 Spanish pesos. During the course of these years, the total profit was well over 30,000 Spanish pesos. Undoubtedly, the periodic slave transactions added socio-economic strength to the family's wealth, and partly provided the necessary capital and social position to engage in the hacendado's role and lifestyle property to the 19th century. Of course, these were not the only means of acquiring and/or maintaining the family's wealth.

The Vives' assets in the 1860s were estimated --according to Carlos Maria's last will, signed and sealed in 1862 and opened in 1872-- at 187,361.94 Spanish pesos. [9[Of this, 80,000 Spanish pesos were his wife's dowry to their marriage. In 1862, the hacienda's value was estimated at 23,659 Spanish pesos. (10] This did not include other assets; for example, slaves valued at 4,800 pesos, cattle, or animals used in production, etc. The hacienda's assessed value, according to the will, was described as follows:

Family's house	4,600	Spanish pesos
Corn warehouse	1,000	" "
Overseer house and warehouse	350	" "
Servant quarters	480	" "
Carriage house	100	" "
Four carriages	190	" "
Two mills and waterways	15,722	" "
Corn in the warehouse (74,926 lbs.)	1,127.52	" "
	23,659.54	[11]

Nevertheless, it is important to point out that the hacienda was not the most valuable family asset, since they heavily invested in urban property and money lending. In Carlos Maria's will, four Ponce houses, with an estimated value of 73,938 pesos, were described as:

A wood structure at Marina St.	5,600	Spanish pesos
A two-story masonry house at Atocha St.	15,500	" "
A two-story masonry house at Atocha and Vives Sts.	36,500	" "
A masonry structure at Vives and Leon Sts.	16,338	" "
	73,938	[12]

Regarding money lending, it is obvious that it became the family's most important economic activity. According to the will, the total amount of money owed to Carlos Maria Vives was approximately 25,600 pesos. [13]

Because of the "industrial" and commercial names that appear as prominent debtors to the Vives, it can be ascertained that in the 1860s the family played a prominent role as purveyors of credit for wealthy hacendados and merchants in the Ponce area. Some of the names, such as Lucot & Co., Armstrong, Coronas, Grau & Co., Carreras & Co., Prats & Co., and Serralles, appeared in the will as debtors. [14] In the context of an economy lacking banking institutions, the family's importance as money lenders is evident.

This leads to the role the hacienda might have played in the indebtedness process. One single instance has been found in which the hacienda was directly linked to a financial obligation. One individual acquired "flours" valued at 3,498 pesos from Carlos Maria's mills. [15]

To what extent, then, was this a common situation? What was the role played by the hacienda's mills in terms of other hacendados' needs, or, to what extent were the mills used in the context so far described? These are questions to be considered throughout the analysis.

But the fact is that in the 1860s the Vives family was a very prosperous and efficient pre-capitalist enterprise, comprising a multiplicity of economic activities and functions as planters and "industrial" producers, credit and financial resources to merchants to hacendados, and later in the century, as coffee producers and processors.

The assets described in the will reflected the hacendado class "elan" within 19th century Puerto Rican society, as it applied to unproductive commodities and to capital deposited in European banks -- 27,000 pesos in a Paris bank and 5,000 in a London bank. [16] On the other hand, it should be recognized that the investment in machinery, along with an extensive hydraulic system, was a strong move towards modernization, keeping in mind, nevertheless, that mechanization alone does not necessarily imply modernization.

It is possible that accompanying the changes affecting the hacienda as an economic and social industrial institution, the Vives family engaged themselves in other economic roles, particularly that of merchants of their own agricultural production, that hacendados, and money lenders. In 1877, the evidence proves that Salvador Vives-Mavarro, son of Carlos Maria and grandson of Salvador de Vives, owned a warehouse in Ponce at Atocha Street, adjacent to a property he was purchasing at the moment (2,900 pesos). [17] The family's records show the so-called "Vives Bros. Co." had commercial connections with Cuba, Venezuela, and New York City for the exportation of coffee, oranges, pineapples, cocoa, and corn flour.

As previously mentioned, land purchasing, as followed by Salvador de Vives, reflected a rational and consistent pattern coinciding with the most active decade in slave purchases during the second quarter of the century. Between 1830 and 1850, the family acquired 824 acres and sold 300. The remaining 524 acres of arable land constituted "Hacienda Buena Vista." [18] The approximate cost of all acquired land added up to 4,230 pesos, but since they sold 300 acres for 2,210 pesos, they probably got the hacienda's lands for 2,110 pesos.

Since land acquisition coincided with slave trade and money lending, it is safe to assume the profits derived from slave trade generated part of the required capital to build up the hacienda's structures:

land, labor, machinery, services, general expenditures, etc. The way the family bought the hacienda's lands is very important. A distinctive characteristic of the original transactions reflect the tendency to acquire, along with the land, their future supply of energy: the waters of the Canas River which actually divides the property. The first acquisitions consisted of 100 acres --including the Vives' waterfall-- for 500 pesos in 1833. [19] Additional purchases of adjacent land estimated at 434 acres were made for 1,300 pesos. [20] The new lands were located on the banks of the Canas River. In 1834, Salvador de Vives bought another plot of 30 acres in the same area under similar circumstances for 120 pesos. [21] Moreover, through another purchase in 1834 (38 acres) and two more in 1835 (40 acres), new acreage was added under identical conditions. [22] Later in the 1840s, an aqueduct was built to supply the necessary hydraulic power to the corn mill --and later coffee husker-- with the obvious advantage of having a perennial water supply as part of their property and at no extra cost.

A rather broad generalization must be made regarding the labor force due to the scarcity of available data. It is clear that slavery was widely used at the hacienda until its legal abolition in 1873. But since coffee production was not intensified until the 1880s, slavery and coffee production were not connected in "Hacienda Buena Vista." It is common knowledge that the free peasantry was another source of labor; so were the "agregados" or sharecroppers. The hacienda seems to have had the typical problem of labor shortage which characterized the 19th century Puerto Rican colonial economic structure. As in the case of Brazil, described by Stanley Stein, one of the problems of the coffee haciendas seems to have been "how to keep labor on a year-round basis to weed the groves, plant new trees where possible, and raise foodstuffs." [23] Oral accounts reveal that "Buena Vista" had a rather typical organization which strived for the maintenance of a secure labor supply within the hacienda's perimeter. Especially after the legal abolition of slavery, the means used by the coffee hacendados to retain a labor supply was indebtedness through the hacienda's store which supplied the basic foodstuffs, clothing, and other goods required by the workers. [24] Indebtedness to the hacienda store implied the possibility of workers contracting their labor to other landowners and, at the same time, the hacendado "reduced the volume of cash needed to pay wages." [25] According to the hacienda's caretaker, Don Nicolas Fernandez, (as late as the first decades of the 20th century --in the 1830s and late 1840s), the system still worked in this manner.

Technology

In its origins, Hacienda Buena Vista was not a coffee hacienda, but a corn mill. In 1848, Carlos Maria Vives, already its owner, was the largest land proprietor in Barrio Corral Viejo (500 acres).

Twelve years later, he still held that position. In 1862, out of the 500 acres, only two were planted with coffee; 24 in "other products," perhaps corn; 200 acres were reserved for pasture; and 372 were forest. [26] In 1867, corn planting was increased to 40 acres, but coffee and "other products" were dropped, leaving 460 acres uncultivated. This indicates that Carlos Maria in 1847, when he received permission from the Spanish Colonial Government to use the river waters "and install a machine" on the farm [27], was actually installing some kind of corn mill which was powered by water. 1847 may be the date of the Barker turbine.

In 1863, the corn mill --the only "machine" on the farm according to the evidence-- was appraised for taxes of 3,000 pesos (the document reads "una maquina de maix"). [28] Ten years later, in 1873, the same machinery was appraised at 2,500 pesos and was described as "a machine to pulverize corn" ("una maquina para pulverizar mais"). [29] The first mention ever found of a coffee mill being installed --or in operation at the hacienda-- is dated 1886. It refers to a plan for the installation of a hydraulic coffee husker. Curiously, the plan is titled "Etablissement de la Propriete des Mrs. Vives."

The available evidence regarding the corn mill proper is scarce and confusing. It is mostly uncorroborated oral evidence from the hacienda's caretaker. According to Don Nicolas Fernandez, the "Spaniards brought the corn mill to the farm and had been in operation since the old days of black slavery" until 1922, when it stopped milling. Apparently, Don Nicolas' father (1860-1945), a small independent farmer in the barrio, might have told his sone or made some remark regarding the corn mill's origins, for he had also been in the corn business and sold corn to the Vives family. Don Nicolas affirmed that he saw the mill in operation but never ventured into the corn mill pit unless the machinery had stopped. By the same way, he had never before heard the term "turbine" or "Barker turbine." He provided information on the corn production and milling processes in general terms.

Corn planting and harvesting took place between February and July, which did not coincide with coffee harvesting and processing. Corn was cultivated outside the coffee-producing areas. The cobs were dried in the coffee drying pans or "correderas." Corn, he said, was husked manually at the coffee house. But since Buena Vista did not become a coffee hacienda until after the 1880s, the corn drying and the coffee husking processes must have taken place elsewhere on the farm instead of in the present coffee house, although no clear records have been found to verify where.

It should be recalled that according to Carlos Maria Vives' will, in 1862, there was a "brick and mortar corn warehouse and two mills with their buildings and dependencies and canals" at the hacienda (the document reads "un deposito de mais de manposteria . . . y dos molinos con sus establecimientos y canals"), all appraised at 16,849 pesos

plus 75,000 lbs. in corn. There was no mention of coffee cultivation and process, or of any coffee mill. The question of the mills is more complicated, since in 1866, Carlos Maria appraised, for tax purposes, not one but "two corn meal machines" ("2 maquinas de harina de mais") for the meager sum of less than 3,000 pesos. [30] It should also be recalled that in 1863 he had declared the value of only one mill. The same story was repeated ten years later, in 1873, one year after Carlos Maria's death.

Were there one or two corn mills built at the hacienda in the 1860s and 1870s and where were they located? Is the actual corn mill the oldest? Is the actual coffee husker a transformed corn mill, thus being the first mill to be established at the farm? Was Carlos Maria supplying inaccurate information to the Colonial Government in order to pay less taxes? This is certainly an historical crossroads.

Nevertheless, a few things seem less confusing. First, in 1874 he received permission to use the river waters and to install one "machine;" second, the tablet in the aqueduct reads "Buena Vista 1851;" third, the first mill encountered in the canal's course is the coffee mill and then the corn mill; fourth, the 1886 plan for the construction of the coffee mill has several references to previous existing structures at the same location and shows noticeable differences between the 1886 design and the existing remains, in both technology and structures; and fifth, a careful study by the team's historian in the surrounding area between the canal's beginning and end and the canal and the river demonstrates that it was practically impossible, due to the existing terrain conditions, that any other structures might have been erected apart from the existing ones. In other words, it is highly possible that the canal system and aqueduct were built between 1847 and 1851 which supplied the necessary hydraulic power to the first corn mill installed in the present coffee mill's location in the 1850s. It is also highly possible that Carlos Maria Vives expanded cultivation and production and corn processing between 1850 and the early 1870s and, as a consequence, installed a second corn mill (the Scotch or Barker turbine?). Furthermore, between 1870 and 1880 --the beginnings of the coffee boom in Puerto Rico and the sugar cane crises-- Carlos Maria's three enterprising sons might have diversified production and subsequently mechanization, thus transforming the first mill into a coffee husking one. At this stage, it should be remembered that one of the three brothers, Salvador Vives-Navarro, was a civil engineer. It is possible that he may have been responsible for the 1886 plan and the mill's transformation.

One final observation in this regard is useful. In 1862, there were 75,000 lbs. of corn in the hacienda's "masonry warehouse." First of all, if the corn volume and weight are considered, and second, if the existing industrial arrangement and structures are considered, the only available space and structure which could hold the corn was the present coffee mill. It will not be possible to solve these questions unless further structural, architectural, and historical research is carried out. [30]

Nevertheless, Don Nicolas was only an eyewitness of the 1910s-1920s events concerning corn elaboration. Therefore, there is no reason to suspect that his description might not fit into, for example, the 1880s or 1890s period; with due reservations, of course. It is undeniable that he saw the corn mill functioning until 1922 and he might be the only individual left who may provide clues to the present problems.

He made the following description[31]: after the corn cobs were dried and husked, the grain was taken to the mill and turned into flour. The corn mill fell through an opening at the bottom of the millstone case to the mill's ground floor into a sieve which was activated by the main shaft and fear and a set of two pullies. The sieving process determined that coarser corn meal was sent back up to be milled again. The corn flour was then packed in sacks which were stencil-labeled with the family's name.

The site's study reveals the existence of the following technology, machinery, and structures designed for corn processing[32]: a waterace comes directly from the coffee husking mill and empties into the corn mill through a strainer and a control valve into a cast iron penstock (11 inches in diameter 7 44 feet long, outside dimensions). The intake capacity of the valve is determined by a manual lever attached by a chain to the valve's handle and activated from the mill. The water flow is transformed into hydraulic energy by sheer gravity since the penstock --which is attached to the corn mill's north wall-- vertically descends 44 feet into the turbine pit. There, the penstock goes underground and discharges from below into a two-arm runner (approximately 9 inches x 8 feet, 6 inches long, outside dimensions) located at the pit's center. At the end of each arm, there is a 1-3/4-inch diameter bronze nozzle, each pointing in opposite directions but parallel to each other. Each jet-nozzle has a perpendicular, independent nozzle needle which acts as a manual adjuster that opens or closes the nozzle diameter at the operator's will, thus regulating the runner's jet-reaction speed. Close to each nozzle is an access port for cleaning and servicing purposes. The "exhausted" energy, i.e., water, goes back to the river along a tailrace.

The water pressure inside the penstock activated the runner as it shot water through the adjustable nozzles. The runner "floated" on a sealed bearing --perhaps acting as a water cushion-- reducing friction to a minimum. The runner's center was connected to a 34-foot long drive shaft formed by three sections. Each section was connected by a coupling and each of the three couplings rested on alignment bearings secured to supporting beams located at different levels inside the wheel pit. The main drive shaft ended in the corn meal sieve and packing room (ground floor).

There were three important complimentary mechanisms on the ground floor. First, the two-belt, wooden pulley system which had to do with the sieving process (now missing); second, the two-spur gear

system (main and secondary) which regulated the speed of the millstones; and, third, the adjustable or tentering bearing which was a simple mechanism designed to raise or lower the secondary shaft attached to the upper or runner stone which determined the coarseness of the corn meal. That is, the adjustable (tentering) bearing determined the milling space left between the runner stone and the bed stone. The adjustable bearing was raised or lowered with a crank and bolt on the first floor facing the stone's vat.

On the first floor --the mill room proper-- the actual corn milling process took place. The corn was not directly poured into the mill; it went through three stages before reaching the stones. First, it was poured into the secondary hopper --above the main hopper-- apparently for measurement purposes. The secondary hopper connected with a considerably larger main hopper which might have served as a temporary storing place. From the main hopper, corn passed through a spout to the smallest hopper directly resting above the millstones/ Another spout poured the corn through the stone eye into the mill. It is possible that the last hopper might have served as a corn-flow control.

Three fundamental, interrelated, and simultaneous activities were carried out on the first floor. It was significant that one individual might have easily controlled energy, speed, and processing in a very brief moment. That is, first, by manipulating the control valve in the headrace with the valve level, above the millstones, milling speed was affected, thus altering the corn-flor into the millstones, which, second, were adjusted with the crank located in the floor by the mill. Finally, any repair or cleaning of the millstones --protected with metal hoops and covered with a wooden plank-- were carried out with the aid of a movable hoist mounted on a wooden rail resting on the overhead beams.

A close inspection of the machinery at the corn mill reveals no manufacturer's trademarks (not even in the cast iron penstock). The "Barker-type turbine" or reaction turbine has the "taste" of a homemade device. No question about it, the "Buena Vista Turbine" seems to be a unique piece of machinery. Since, first of all, it is not a Barker's centrifugal (or reaction) wheel, although --and the possibility is not remote-- it might be a transformed one:

> Dr. Baker's mill consists of an upright pipe or tube, with a funnel-shaped open top, but closed at the lower end; and from the lower end project two horizontal pipes or arms, also closed at the outer ends, and placed opposite to each other, at right angles with the vertical tube, so as to form a cross. Near to the end of each horizontal pipe, and on one side of it, is a round hole, the two holes being opposite to each other. The upright pipe is mounted upon an axis or spindle, and is kept full of water flowing into the top. The water issuing from the holes on the opposite sides of the horizontal arms, causes the machine to revolve rapidly on its axis, with a velocity nearly equal to that of the effluent water, and with a force proportionate to the hydrostatic pressure given by the

> vertical column, and to the area of the apertures; for there is no solid surface at the hole on which the lateral pressure can be exerted, while it acts with its full force on the opposite side of the area.

According to this description, the "Buena Vista Turbine" does not fit within the Barker's category. The differences are too obvious. Nevertheless, the wheels have an element in common, i.e., the arms are very similar as long as they refer to shape, position, and function. But on the other thand, it is not a Scotch turbine, either; being this Barker's modification. If the Scotch turbine description is confronted with "Buena Vista Turbine," some differences are noticeable, especially on the arms. But key similarities are revel revealed as, for example, in the flow of water. Apparently, the "Buena Vista Turbine" builder used the Scotch turbine principles to make the one on location, adapting at the same time the Barker's design, adding improvements on its own, i.e., the bronze nozzle, adjustable needle, and access ports. But, and here lies part of the problem, it could also be a Barker's wheel modified into an "improved" Scotch turbine. Could it be a technological hybrid? It is possible. It is interesting that in mid-19th century --while the hacienda was being developed-- the Scotch turbine was being patented in the United States, based on European designs:

> Dr. Desaguliers, Euler, John Bernoulli, and M. Mathour de la Cour, have treated of this machine (the Barker's mill); and the large pipe from an elevated reservoir, to bend the lower part of it upwards, and to introduce it into a short pipe with two arms like Dr. Barker's mill reversed, and revolving on an upright spindle in the same manner; the joint between the two pipes being so contrived as to admit of a free circular motion without much loss of water. By this arrangement, a fall or column of water of any height, however great, may be rendered available. This arrangement was proposed in 1775. Some few years ago, Mr. James Whitelaw, of Paisley, attempted the improvement of this machine, and took a patent for his improvement, of which published and account in 1845. This would seem to consist chiefly of the modifications recommended by Dr. Robinson and M. Mathon de la Cour, and one of the bending of the two horizontal arms into the form of the capital letter S: the water being discharged from the ends of the arms, in the direction of the circle traced by their revolution, or in that of a tangent to it. The curvature is that of an Archimedean spiral, with the extremity of the arm or jet piece continued for a short distance in a circular curve, coincident with the circle described by the end of the arm.

(Joseph Glynn, Rudementary Treatise on the Power of Water, London: John Weale, 1853, pp. 50-55)

If further analysis is made on a contemporary source, it can be determined that the "Buena Vista Turbine" adapted elements from both designs. But the problem is when, where, why, and by whom these adaptations were made. Any answers require further archival research, possibly and hopefully, in family records. In other words, at this point the in situ artifacts are not "clear" historical evidence to the extent that they challenge prima facie analysis.

Another complex question is posed by the attempt to determine how a constant, rational speed was established at the mill. There seems to be several alternatives, either by the amount and/or size of the water columns inside the penstock --determined by the valve and the gates in the canal-- or by the reaction nozzles at the turbine --their diameter being adjusted manually--, or by a particular combination of both. The answer is not clear, but in any of the three instances, a link seems to be missing.

The main structures at the corn mill are wooden. The hardest woods available have been identified as "guayacan, ausubo, and capa blanco." Some of the sawing marks in beams, supporting beams, including those in the pit, indicate the possibility that much of the lumbering, wood arranging, etc., were done locally. Some of the pieces are impressively massive --1 foot x 1 foot x 6.6 feet--; their quality explains why they are free of termites or other insects. Some of the building's walls and floor panelling --apparently made of imported and untreated peach pine-- are in an advanced state of decay.

The ground floor --sieve room-- is mainly brick and plaster, as are the pit and the tailrace. The pit --10 feet x 12 feet x 32 feet-- was excavated in a steep mountain slope. Its mouth, leveled with the ground floor, is covered with wooden planks on top of which rests another wood structure --a bench-type supporting element-- which holds in place the spur gear and pulley systems, the tentering bearing, and the millstones. The weight of the machinery and supporting wooden structures is diverted to the pit walls by two arches inside the pit.

The tailrace, like the pit, was excavated into the mountain slope. It is a narrow passage, barely 3 feet wide. Its walls, being considerably high, have no ceiling. To some extent it resembles a high trench. The highest point from the tailrace floor to land surface is approximately 28 feet. The "trench" walls are held in place by three wall to wall buttresses that neutralize the compressing hill slope pressure.

* * * * *

TURBINES	WATER FLOW	ARM SHAPE	ARM OPENS.	OPENS ADJUSTERS	ACCESS PORT
Barker's	top	horizontal	round	no	no
Scotch	below	S shape	rectangular	no	no
Buena Vista	below	horizontal	round	needle type	yes

The connecting element between the corn mill and the coffee husking mill is the corn mill headrace. It has several characteristics of its own. First, it is build of brick and plaster, as the rest of the canal. Second, a set of gates, approximately 5 feet from the corn mill's water valve, divert the water either to the corn mill's penstock or to a tailrace back to the river. Third, a few feet north of the gate system is a depression on the canal's floor --approximately 5 feet long x 1.6 feet deep--, and a "cleaning" pipe on its bottom which opens into the canal's outside wall. The canal section between the depression and the corn mill is lower than the pre-depression canal floor. Furthermore, the depression's side facing the forn mill is slanted while the opposite side is vertical or slightly tilted forward (i.e., towards the depression). The purpose of this device is open to conjecture, although all of its elements indicate that it was designed to alter the normal flow of water in order to cause either turbulence or to brake the downhill water speed. At one point, it was thought that it might have been used to collect dirt or residues from the coffee husking mill, in order to avoid any clogging in the corn mill or reaction turbine; but it was found that husked coffee residues float, thus the reason for the strainer in the water valve. Therefore, the "cleaning pipe" at the bottom of the depression seems rather senseless. A more feasible explanation is that the purpose of the depression is to lighten the weight of water as turbulence "airs" it. The other possibility is the depression, acting as a brake, created a "settled" water pool required for a steady water supply in both the penstock and the turbine. Whatever the reason, it warrants further research.

The canal section between the depression and the coffee mill's waterwheel tailrace, or in other words, the waterwheel's sluiceway to the corn mill, is approximately one-fifth covered with a landslide --the northwest section of the coffee drying terrace collapsed-- which precisely occurred at the point of union of the waterwheel tailrace and the corn mill canal. For the time being, it will not be possible to determine for certain what the canal looked like. But, as in other instances, the surrounding premises were combed. The findings suggest that the waterwheel tailrace might have been modified, or adapted, to divert water to the corn mill through either a continuous canal or by a two-gate system. If the latter was the case, the gates were located approximately 15 to 20 feet below the coffee drying terrace level on the side of a very steep slope -- practically a cliff -- which leads to the river banks. If, on the other hand, there was a continuous canal from the tailrace to the corn mill, it had to turn abruptly south about 20 feet from the waterwheel in a 90° to 110° angle. The possibility of a modification in the canal stems from the fact that the tailrace walls seem to have extended well beyond the hypothetical connecting point --pointing towards the river-- as they formed lateral protecting walls (similar to the corn mill's). Then, it is reasonable to speculate that the corn mill canal was a later addition.

The first section of the husking mill canal was built on the Canas River in a location named "the Vives Waterfall," the same location purchased by Salvador de Vives in 1834 (58 acres for 360 Sp. pesos). As already stated, thirteen years later, he was authorized by the Spanish Colonial Government to construct it, a job which took three to four years. By 1851, the canal and the aqueduct were finished and the hacienda was named "Buena Vista." [33]

The canal's course from the river to the coffee mill is exceptionally beautiful; it meanders for 300 feet along the hill's steep slopes. With the exception of its starting point, the sparking waters flow smoothly. There is no rush in its way. Here and there, the canal giggles, gargles, and bounces back blue light filtered through the green mesh of mango, organge, cocoa, yagrumo, annato, and coffee trees. The wild pigeons' monotonous basso voices counterpoints the nightingale's versatility which in turn compares only to the sound of the passing, sinuous waters. As the canal briefly moves underground to avoid a difficult passage, the waters murmur in deep tone voices through the four vaulted access openings as if mocking the wild pigeons. The canal, carefully and graciously constructed, follows its tranquil downhill course. At several points, the waters seem dead still, revealing through its crystallized transparency the exquisite attention given to the structural details of the 125-year-old canal: the symmetric laying of the bottom bricks; the leisurely designed curves; the absence of roughness; its paradoxical integration with nature; its deep-green wild fern-covered sides; the delicate pink, salmon, yellow, and white lazy susans; and the pale-violet wild hydrangea. Black and yellow butterflies, old-gold hued bees float in the humid air. The emerald-green, blue, and purple-red hummingbirds zoom to perch from their brown beaks on a deep red wild hibiscus. The multi-form, multi-color spiders ignore the passing of time through invisible nets for the careless intruders that dare disrupt the genetical secrets of their geometrical knowledge. The brown poisonous centipedes waltz on the ocre and humid green color of the hacienda's soil. The long millipedes take refuge under the decaying leaves, while the canal waters are saddled by the aqueduct. The moving simplicity of the 30 feet long, one-eye brick and plaster aqueduct and the tablet that silently divulges a certain geographical location to the surrounding mountains, counterbalances the magnificent intricacies of the tropical forest, the tumultous rain, and the rushing river waters. The tablet inscription reads: "Buena Vista, Ano de 1851."

A short distance from the aqueduct, the canal enters the coffee husking mill. [34] Suddenly, the water gains speed, disgorges, and splashes into the darkened entrails of the old mill. The encased water rumbles like a distant thunderstorm. But nothing else moves, nothing else murmurs; not the humid dripping walls, the slimy brick floors, or the rotting beams. The rusted Baroque shell of shafts, gears, and pulleys tell a sad story.

At the turn of the century, more than 10,111 lbs. of coffee --Coffea Arabica variety-- were produced and processed at "Buena Vista." The oral sources indicate that a quasi-scientific method was used in coffee planting, cultivation, harvesting, and processing.

It is general knowledge that coffee was introduced from the East (Arabia and Yemen) to Europe during the 18th century. Louis XIV of France provided shelter for the plants at the Paris Botannical Gardens, from where it was transplanted to the French possessions in the Caribbean. From these islands, it was introduced in the Spanish colonies in the 1740s and 1750s.

Coffee is a tropical plant that does not successfully grow outside 23° north and south latitudes, in low or coastal lands, or above 1000 meters sea level. With some exceptions, it can stand a low 12° C.

The Puerto Rican variety of coffee most extensively cultivated was Coffea Arabiga. It is described as follows: [35]

> Coffea Arabiga: Shrub or small tree which may grow as high as eight or nine meters; which resembles the cherry trees when covered by fruits; whose bark, roughly surfaced, is greyish in color; whose branches, long, flexible and separated from each other, bear fruit during all stations; whose foliage is consistent. The leaves of the named Arabiga coffee-tree are always either eliptical or oval, or slender on both sides; their width ranges between a centimeter and a half to five centimeters, and its length, from five-and-a-half to twenty centimeters. The peduncle point measures from one to one-and-a-half centimeter. The limbo has nine to twelve secondary fibers next to the principal one, all of which are clearly convex; they can be seen perfectly well on the upper side of the leave, which is of a bright green. The flowers are grouped in clusters of three and five on the trunk of the leaves, and each group of three is surrounded by four bractlets, two triangular and two elongated ones. These bractles seldom grow beyond the calyx. The flowers are not long lasting, but are reproduced several times a year. These flowers resemble somewhat those of the Spanish jasmine, and emanate a penetrating odor, sometimes too penetrating. They have a calyx with five, very small, divisions, almost imperceptible. The corolla has five divisions, and a tube half a centimeter long. The small stamens have a very short filament (15mm), and anthers from 60 to 70 mm. The two stigma, which may be up to 70 mm long, protrude from the corolla's tube, the style measures 1.5 cm. long, although on certain occasions it is shorter, and is hidden within the corolla's tube.
>
> These, the stamens and the style disappear after fertilization; but the ovary, surrounded by the calyx, remains and bears fruit. This fruit is generally oval, and in its uppermost part, under the form of a coronet, what is left of the calyx, can be easily seen.

> The fruit of Coffea Arabica is known by the name of cherry. When ripe, it is yellowish red, and in rare conditions, yellow or white. The skin of the fruit has three parts: the exterior which is very tight "parchment;" the second is a weak tissue: and the third is a thick layer which resembles an almond skin --strong and resistant-- but thinner. The last layer forms, in the fruit's center, a partition which divides the cherry into equal parts.
>
> In each of these parts, there is a grain, convex on its external part, and flat with a central groove, on its internal part. The grain has a very thin tegument, which is often missing on the grain which is sold; in the interior is the coffee grain composed of a horny albumen surrounding a straight embryo of foliaceous cotyledons.
>
> On occasion, one of the two grains aborts; and then the one left outgrows itself and instead of growing flat on one side, it becomes more or less convex; but it always has the groove in one of its sides. (NOTE: In Puerto Rico, this coffee grain is called "caracolillo" --peaberry-- and it is considered the best.) The coffee grain is composed solely of the embryo's albumen. Sometimes this almond is covered by a fine and silvery film, which is nothing but the tegument. In these cases, the grain is always whole.
>
> If this grain has a parchment-like covering, formed by the inner parts of the fruit, it is called "parched." Commonly, the grain has no parchment, since it is smaller than the last by dryness. The whole fruit, carrying the two grains or one single grain, with parchment and fruit forms what is called the cherry. The pulp covered by the parchment is usually thin, fleshy, somewhat sweet, and can be easily removed.

Puerto Rican coffee was in high demand in Europe because of its high quality and special taste, especially the "caracolillo" variety. For instance, in 1891, buyers in international markets paid from US $26.00 to $28.00 per 100 lbs., while the Brazilian variety stood between $19.00 to $24.00. [36] In 1896, the total value for the Puerto Rican coffee production in the international markets was close to $14 million. [37]

The description provided by the hacienda's caretaker regarding coffee cultivation and production generally matches Lopez Tuero's. [38] The best coffee was produced in the central mountain areas of Yauco --west of Ponce--, Lares, Maricao, Utuado, and Cayey. The region is characterized by constant spring weather; light breezes, frequent rain, high humidity, red, firm but porous soil, and lands well-protected from strong winds. Nevertheless, coffee growers, such as

the Vives, considerably modified the natural environment, assuming that coffee growing required large tall trees to provide shade from strong tropical light and protection from strong winds.

Coffee cultivation began with seeding in February. The best whole coffee beans in weight, volume, perfection, and roundness were selected as seeds. These were planted in rich, cleaned, well-drained soil, in rows about two inches apart. In one month or so, the seeds germinated and remained in the seedbed for one to one-and-a-half years until the young trees were approximately one foot high, or had three sets of branches or "crosses." During the growing season, the soil was kept free of weeds, insects, etc. In "Buena Vista," the small trees were protected from direct sunlight with a shed of dried Royal palm tree leaves.

Apparently in "Buena Vista," prior to the final planting, the trees were pruned of all branches and leaves, except the first set of "crosses." The trees were very carefully removed from the seeding site and special care was taken to keep the soil around its roots and not to damage the central one. This was accomplished in the hacienda by wrapping the roots in coarse dampened burlap rags, packing them in special wooden boxes, and transporting them by hand to their final planting location.

The new trees were planted in rows, or "calles," 6 to 8 feet apart with the same separation among trees. The holes, round or square, were approximately 1.6 feet wide. The planting would take place in glens or on slopes. In "Buena Vista," planting was primarily on slopes and most of the cultivation was done by hand. Apparently, no fertilizers were used in the hacienda until very recently, although manure, ashes, and phosphates were used in other coffee areas.

The caretaker did not provide information regarding further pruning, although he suggested that some was done after the first flowering --usually in the third year-- and after coffee harvesting. The scientific method used in Puerto Rico in the late 19th century pruned only after the tree was three years old, and apparently before its first blooming. The trees were selectively pruned to give them shape, strength, direction, productivity, and accessibility to the coffee berries. After the third and fourth years, the lower branches were cut off. In the fifth year, the tree was topped off in order to stop vertical growth. On the 6th and following years, the final shaping of the tree began. The tips of the upper "crosses" were cut off to stop horizontal growth, thus provoking the development of smaller internal branches which would become the active ones generating flowers and beans. By the end of the 6th and 7th years, the tree had a clean pyramidal shape with strong protective upper "crosses" and delicate internal producing branches. The trees at this stage would be 5 to 8 feet high. Throughout their productive years, which began when trees were 5 to 6 years old, the coffee trees were pruned of old and dead branches, new branches that might change the trees' shape, and unproductive, deformed, and broken branches.

The trees bloomed between February and April. The white flowering season was described by the caretaker as "preciosa" (beautiful) since

the flowers gave "un olor a perfume que transcendia" (a transcendent --sic-- perfume).

The coffee beans, originally green, turned into yellow, red, and purple red as the ripening period reached its peak at harvest time between September and November. In the case of Puerto Rico --in order to keep quality-- the ripe coffee beans were handpicked one by one at their prime. At "Buena Vista," it took more than a month, sometimes two, to harvest all the coffee. The beans were collected in handmade straw baskets, "almud," 1.75 lt. capacity, hanging from the neck or waist of the coffee pickers. The picking process was called "ordenar el arbol" (milk the coffee tree). The "almud" was emptied into larger straw baskets and handcarried by the pickers, or on mule, to the coffee husking mill.

In "Buena Vista," more than 50 pickers were employed in the early 20th century. Sometimes entire families, including grandparents, were hired as workers. After the harvest was over, the hacienda peons proceeded to "levantar" (raise) the coffee trees, since the pickers, by reaching for coffee berries, forced the branches down. This step was accomplished by fastening "horquetas" (5 to 8 feet long branches resembling a long-handled Y) to the branches.

* * * * *

The remaining machinery and industrial structures at the hacienda coffee mill prove that "Buena Vista" coffee was subjected to at least seven different processing steps: pulping, washing, drying, husking, airing, selecting, and packing (despulpado, lavado, secado, pilado, aventado, seleccionado, and empacado). As soon as the coffee reached the mill, it was carried to the first floor, measured on the metric coffee bean pails, and poured into the coffee bean hopper ready to be pulped on the mill directly below the hopper.

Some facts about the remaining structures, energy resources, and machinery at the coffee mill should be stated at this point. With the exception of the massive supporting beans of the structures and the machinery, all other wood areas such as floors, ceilings, and walls are in an advance state of decay due to the high humidity and direct contact with water. There are some indications, as in the corn mill, that lumbering was done on the premises and that extensive transformations were made on several sections of the building, especially in its wood sections (e.g., the floor above the coffee husker was an addition). Brick and plaster were reserved for primary floors, industrial areas, supporting walls (e.g., waterwheel pit and some outside walls), and the drying oven. Some of these areas also suggest extensive alterations: the architecturally-awkward entrance to the building's first floor; the inefficient space-relationship between the washing basin area on the ground floor and the outside drying terrace outside the building; and the complete inaccessibility to the coffee husker, indicating that an entire floor is missing. The husker is entirely covered by the building's first floor. There are also indications that additions were made to the original brick

and plaster structures. The most striking fact about the building is its peculiar space arrangements since the actual industrial spaces are not conducive to an efficient use of the coffee-processing areas. For example, the transit from the pulping-washing areas to the husking area is through three very steep steps (10 feet high altogether), seriously impairing movement and access. Is this built-in awkwardness, or was it the result of extensive rebuilding? Might there be other reasons?

Hydraulic energy was not used efficiently. The canal, as a main artery, takes the Canas River's waters to the husking mill, where it is distributed by a combination of a water manifold and a three-waterway system. [38] At the manifold, it is either directed to the waterwheel or sent back to the river along two sluiceways, one of which crosses the hacienda courtyard, or batey, where it once served as a drinking trough for cattle and for decorative purposes. The canal to the waterwheel has three control waterways, two of which are calibrated and of simultaneous operation, apparently. The heart of the hydraulic system is the central waterway at the manifold, which can be raised or lowered according to the level of water desired as expressed on a wooden caliber. A similar mechanism existed on the overshot waterwheel watergate. That is, the mechanical remains strongly suggest that the water flow to the waterwheel was rationally and scientifically double-checked with a calibrated homemade device. The third waterway is located exactly between the other two and consists of a double purpose floor-trap watergate. As it was closed, water flowed to the waterwheel and the pool from which the pump took water for the old pulping mill. If it was opened, it allowed water to fall through an 18-foot-deep brick and plaster bypass sluiceway to the corn mill, leaving the waterwheel undisturbed.

The remaining pieces of machinery indicate that the entire set-up, as a processing unit, was both a waste of hydraulic energy, of which there was plenty, and that it was subject to senseless mechanical wear. (This reinforces the suspicion that the husking mill is also a homemade device.) In order to understand this, it should be made clear that coffee pulping, washing, and drying were not simultaneously carried out with coffee husking and packing. The first three processing steps took place more or less at harvest time; the other two began in November. Nevertheless, the old pulping machine could not be used without putting into motion the entire processing plant. [40] Why this mishap? Simply put, the old pulping mill required considerable amounts of water as the ripe coffee berries passed through the pulping crusher or cylinder. This problem was solved by a pump which was activated by a fixed arm connected to the waterwheel by a second missing arm and a gear (possibly eccentric). Thus, in order to have water in the old pulping mill, the waterwheel had to turn. But this also implied that the last was working without milling while the pulping cylinder was in operation, since there is no disconnecting mechanism between the main gear, the conic pinion, the drive shaft, the two belt pullies, the four-gear system, the secondary shaft, and the husking mill. The absence of a husking mill

cluth mechanism accounts for this situation. But, and this is the tragi-comic side of the story, the pulping mill shaft and gear could be disconnected from the four-gear system and secondary shaft with a manual clutch located directly underneath the husking mill. Thus, while the coffee husking mill was in operation, the pulping mill stood still.

The old pulping mill, according to the caretaker's verbal account, was an inexpensive and ingenious mechanism. It is the same one depicted in the 1886 plan, and its addendum. It was mounted on a wooden frame in the same location of the actual electric two-disc pulping machine. A wooden box contained the basic elements: a spike bronze cylinder and two "blades." The cylinder rubbed the coffee berries against one of the blades dislodging, with the aid of water, the coffee grains from their skin. The other "blade" sent the grains in the direction of the washing basin, and the pulped waste in the opposite direction. As the old pulper was installed facing south --in the direction of the washing basin-- it had a gear on its right side which was connected to the pulping mill gear (in situ). On the opposite side, the left, it had a four-hump gear connected to a strainer or sieve (missing) which collected the pulped coffee. As a consequence, the strainer moved with an up-down movement, segregating pulped from unpulped berries.

The coffee husker is a good piece of wood craftsmanship. According to Don Nicolas, the huskers or "tahonas" were built by local artisans from the best and hardest domestic woods available. It consists of a flat-bottomed circular canal along which rotate two parallel wooden wheels -- approximately 5 feet in diameter-- attached by an axle to a central pivot. The wheels rub the dried coffee beans against the bottom and sides of the canal in order to break loose the dried internal skin or husk from the coffee bean proper. Two stirrers (missing) were connected to the same pivot by an axle perpendicular to the first turn of the coffee along the canal. The pivot is actually the secondary shaft tip, connected through a four-gear system to the drive shaft.

The major mechanical pieces: pulping mill gear system and the clutch; four-gear system and secondary shaft; drive shaft; conical pinion; main gear wheel and pump gear are all cast iron and bear no manufacturer's marks. The largest of these is the main gear, approximately 9 feet in diameter. They are heavily greased and were once painted deep red-orange.

The remaining mechanical elements are wooden, including the four-legged supporting bench on which the tahona rests. Between the legs of the supporting bench, two bell pullies are found. The smallest one (on top) is 3.6 feet in diameter and the largest is 6 feet. On the eastern side of the supporting bench, there is a pair of wooden pulley guides parallel to the pullies themselves, but in a somewhat eccentric position. The purpose of pullies and guides is not

altogether clear, although, according to the caretaker, there was once a ventilator (to separate husk from coffee); a strainer (to separate husked from unhusked coffee); a saw mill; and a salt mill all connected to the belt pullies. Nevertheless, the wear of the pullies indicate they were heavily used.

The wooden waterwheel is of the overshot type. It is 16.6 feet in diameter and approximately 2.6 feet wide and has 56 buckets. The waterwheel moves from east to west. It rests on two bearings attached to the brick and plastic waterwheel pit walls (they are approximately 19 feet high and 2 feet thick). The pump gear is north of the wheel's axle and the main gear is directly in the opposite direction inside the building in the pit directly below the supporting bench.

Finally, the electric pulping machine (in situ) is a two-disc type pulper which operates on the same general principle as the old one: the ripe coffee berries were pulped by one spiked disc rotating against a stationary one, thus freeing the coffee beans from their outer skin.

Coffee pulping was the first step in its processing. [41] After the harvested coffee was measured and poured into the hopper, it was funneled to the pulping machine. The berries were mashed or rubbed as described. The strainer, located in front of the pulper, allowed the pulped berries to fall into the washing basin and collected the unpulped. These last were put in a straw basket and taken back to the hopper through a trap in the ceiling directly above the pulper. A pulley, located on the first floor close to the hopper, served to hoist the basket. The pulping process was called "repase."

The pulped beans were covered with a viscose substance which had to be removed. The next stage consisted of a thorough cleaning in the pool or washing basin. According to oral sources, this was accomplished at "Buena Vista" by washing the coffee three times as it lay in the washing basin flooded with water. The pool was agitated with long-handled wooden rakes. The best sank to the bottom of the pool, while the broken or "empty: coffee beans surfaced. The empty beans and the broken grains were kept aside from the best coffee beans. After the washing process was over, coffee was taken to the glacis, or pulped-coffee crying terrace, to be dried.

The drying stage had two steps at "Buena Vista." First, the coffee was sun dried for 2 or 3 days on the glacis or until it did not have visible accumulations of water. Then, it was transferred to the storage and drying shed building (42], a two-story wooden structure south of the husking mill. The first floor was used for coffee storage, but on the ground floor were located the wooden sliding drying pans or "correderas" (each approximately 8 feet x 18 feet x 6 inches). The 24 "correderas," 12 on the north side of the building and 12 on the south, worked as a file. There were three

in a horizontal row and four in vertical arrangement. They were mounted on iron wheels, three on each side, and iron rails and moved similarly to train coaches. The "correderas" were filled with semi-dried coffee beans, as brought in from the glacis. At daylight, the drying pans were pulled from their shelter and their contents exposed to the sun. If there were continuous rain, coffee could be dried on the metal pan on the oven at the husking mill. The berries were dry in three to five days. They were then packed and stored on the first floor, ready for husking.

According to Don Nicolas, the "pilado," or husking, at "Buena Vista" was done on pestles or "pilones" and not in the "tahona." He insisted that the husker stopped milling long before he arrived at the hacienda in the 1910s, but could not supply information as to why. Coffee husking in the "pilones" was a simple, rather primitive, procedure: the berries covered with the husk (or "cafe en vaina") was poured into the pestle and pounded with approximately 30 lbs. weight handles, or "macetas," until they were free of husk.

As a result of the "pilado," the coffee beans were mixed with the coffee husk called "paja." The sixth stage of coffee processing, the airing or the "aventado," which actually blew away the broken husk, consisted of creating an air current with a manual fan. Coffee was taken from the "pilon" and allowed to fall in front of the fan. (If the "aventado" had taken place at the husker, a strong air current would have been created by a set of moving blades or possibly a ventilator activated by the husker itself and located at the exit of the coffee husker, usually an orifice in the canal's bottom).

Only then was coffee ready for the market. But, first, it was carefully packed in clean wooden boxes, marked with the family's stencil and stocked in the dryest possible location in the coffee storage house. Extreme care was given to avoid any contact between the coffee and any humid object, strong smelling fruit or vegetable, or anything exhuding strong aromas, since husked coffee absorbs surrounding odors.

Although this does not seem to be the case at "Buena Vista," in other coffee producing areas, polished coffee was taken, prior to packing, to a special set of tables called "mesas de seleccion" where its final quality was manually determined by laborers, usually women. This was the traditional 7th stage, coffee selection ("seleccionado"), in the long and expensive chain of steps in the elaborate process. It consisted of segregating coffee beans, grain by grain, according to predetermined quality standards. There were four major coffee categories in order of excellence:

1. "Cafe caracolillo" or peaberry coffee, already described.

2. "Cafe selecto" or selected coffee: whole, unbroken, sound, polished grains

3. "Cafe triache": whole, small, unbroken, dark beans

4. "Cafe partido" or broken coffee: defective, broken, lightweighted beans

* * * * *

For all practical purposes, Hacienda "Buena Vista" was an independent socio-industrial unit. Its umbilical cord with the outside world was first corn and then coffee. They traded with other islands of the Caribbean, South American, Europe, United States, and other parts of the world. These economic contacts expanded the social and economic vision of the Vives family: some of them were educated in France as doctors or engineers; married women from Spanish society; bore their children there; and, in general, shared an European fin de siecle lifestyle.

Their hacienda reflected their particularly developed and exalted taste for life: the location of the site, the architectural details, the house -- the everpresent house, always asserting its ruling qualities from where everything could be seen and observed. Its balcony opened to the courtyards, a bubbling little market-like place. At the other end of the house, the masters had their French garden. It was their private world, exclusively designed for them.

All these things are now gone. The hacienda is a ghost; the caretaker's house, the stables, the carriage house, the storage building, the hurricane shelter, the mule stables, the caretaker's office, the corn mill, the coffee drying shed, and the hacienda house all lie inert. A musty smell reigns everywhere. The grayish buildings rest in the silence imposed by the growing lushness of nature. The canal gurgles barely audible sounds. Everything is gone, even the sadness and suffering of the black slaves and the indebted workers who made possible the master's world. Even their poverty-stricken barracks and huts have suffered the encroachment of humidity, mildew, termites, and decay.

Footnotes

1. Archivo General de Puerto Rico (AGPR), Protocolos Notariales (PN), Ponce: Luis Capo, 1844, f. 397.

2. AGPR, PN, Ponce: Leonardo Morel, 1830, f. 337.

3. AGPR, PN, Ponce: Francisco Parra, 1872, f. 372.

4. AGPR, PN, Ponce: Leonardo Morel, 1830, f. 337-8, 528.

5. AGPR, PN, Ponce: Ramon Jimewnez, 1843, f. 433.

6. AGPR, PN, Ponce: Francisco Parra, 1872, f. 372-ss, 500-506.

7. AGPR, PN, Ponce: Leonardo Morel, 1830, f. 544; 1831, f. 260, 520, 644, 649, 698, 817; 1834, f. 355, 457, 600; 1835, f. 684; 1835, f. 684; 1836, f. 724; 1837, f. 110, 129, 419, 436, 459, 480, 505, 547, 892, 895, 962; 1838, f. 57, 147, 218, 227, 661, 750; 1839, f. 380, 400, 566, 693, 818; 1840, f. 959, 991, 1162; 1841, f. 294; Luis Capo, 1843, f. 134, 166; Ramon Jimenez, 1843, f. 365, 453, 499, 525; Luis Capo, 1844, f. 241, 314, 371, 373; Ramon Jimenez, 1844, f. 407, 408, 453; 1845, f. 108; 1846, f. 316, 336, 337, 411; Rafael de Leon, 1849, f. 395; Francisco Pasarell, 1849, f. 372; Rafael de Leon, 1850, f. 185; Rafael de Leon, 1851, f. 152, 321; Francisco Para, 1851, f. 233; Rafael de Leon, 1852, f. 333; Francisco Parra, 1853, f. 73, 286; Rafael de Leon, 1855, f. 293; Francisco Parra, 1860, f. 261, 760, 765; 1861, f. 150; 1863, f. 235; 1864, f. 446; Rafael de Leon, 1865, f. 250; Francisco Parra, 1866, f. 58, 67; Francisco Parra, 1871, f. 303.

8. AGPR, PN, Ponce: Francisco Parra, 1871, f. 303.

9. AGPR, PN, Ponce: Francisco Parra, 1872, f. 500-506.

10. AGPR, PN, Ponce: Francisco Parra, 1872, f. 500-506.

11. AGPR, PN, Ponce: Francisco Parra, 1872, f. 501.

12. AGPR, PN, Ponce: Francisco Parra, 1872, f. 502.

13. AGPR, PN, Ponce: Francisco Parra, 1872, f. 502.

14. AGPR, PN, Ponce: Francisco Parra, 1872, f. 502.

15. AGPR, PN, Ponce: Rafael de Leon, 1865, f. 243-244.

16. AGPR, PN, Ponce: Francisco Parra, 1872, f. 50.

17. AGPR, PN, Ponce: Francisco Parra, 1877, f. 2107-2108.

18. AGPR, PN, Ponce: Leonardo Morel, 1833, f. 751, 790, 793, 984-86; 1834, f. 293, 611, 455; 1835, f. 1039-1041; 1841, f. 40, 106; 1845, f. 152; 1848, f. 187; 1850, f. 209; 1852, f. 522, 565; 1858, f. 436.

19. AGPR, PN, Ponce: Leonardo Morel, 1833, f. 751.

20. AGPR, PN, Ponce: Leonardo Morel, 1833, f. 790, 793.

21. AGPR, PN, Ponce: Leonardo Morel, 1834, f. 293.

22. AGPR, PN, Ponce: Leonardo Morel, 1834, f. 611; 1835, f. 942-3; 1039-1041.

23. Stanley J. Stein, Vassouras, A Brazilian Coffee County, 1850-1890: The Roles of Planter and Slave in a Changing Plantation Economy, (New York, Atheneum, 1970), 260.

24. cf. ibid., pp. 267-268.

25. ibid., p. 268.

26. Archivo Municipal de Ponce, Ponce: Padrones de Tierra, leg. 13.

27. Archivo Municipal de Ponce, Ponce: Estancias, leg. 3, exp. 65. Riego, leg. 40, exp. 392.

28. Archivo Municipal de Ponce, Ponce: Padrones de Capitales y Productos de las Rigquezas de este Partido, leg., 3, exp. 913.

29. Archivo Municipal de Ponce, Ponce: Planillas Industriales, leg. 119, exp. 25.

30. For unknown reasons, the Supervisor Architect did not incorporate the 1886 Coffee Mill Plan into the HAER Buena Vista drawings nor make a strucktural comparative analysis with the existing structures.

31. Don Nicolas Fernandez was interviewed several times. Two of these conversations were recorded on July 14 and 15, 1977. They are filed with this report.

32. 1977 HAER Hacienda Buena Vista drawings, pp. 6-8. Hereafter quoted as BVD.

33. BVD, pp. 2, 3, and 4.

34. BVD, pp. 9, 10.

35. G. Cormaillac, El cafe, la vainilla, el cacao y el te. (Barcelona, Sabater, 1903), p. 21-6. v. also Jorge E. Saldana, El cafe en Puerto Rico, (San Juan, Real Hermanos, 1935).

36. Fernando Lopez Tuero, Cafe y pina en America (San Juan, Acosta, 1891), 7. The author was Director of the Agricultural Experimental Station in San Juan.

37. Saldana, p. 7.

38. The caretaker's observations are interjected in Lopez Tuero's descriptions.

39. BVD, 10, 12.

40. BVD, p. 11, 12.

41. BVD, p. 10.

42. BVD, p. 4, 5.

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(Hacienda Vives)
(Buena Vista Plantation)
PR Route 10 (Ponce to Arecibo)
Magueyes
Municipality of Ponce
Puerto Rico

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